Non-Indigenous Species Invasions in the Western United States

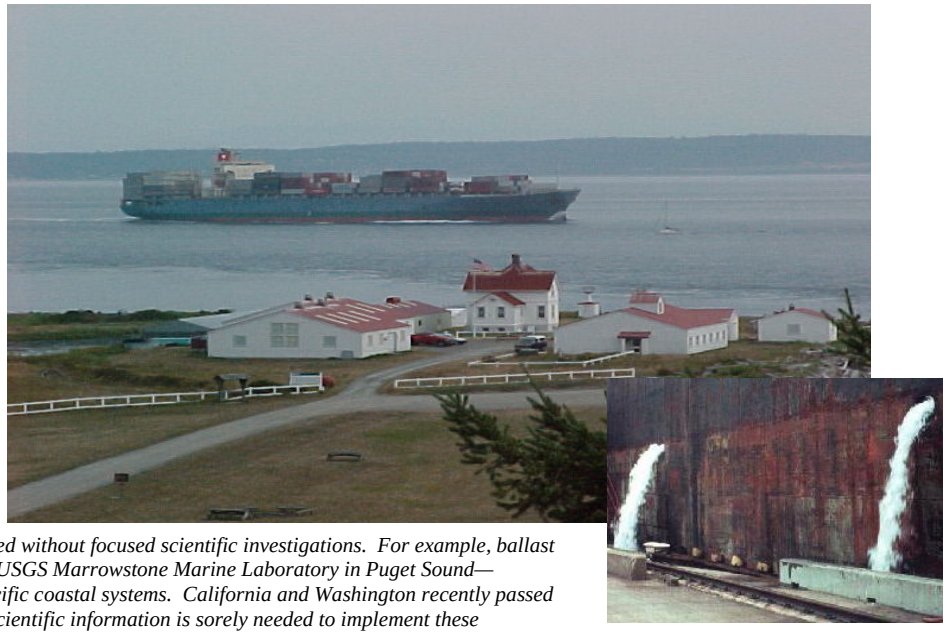
More than 6,500 non-indigenous species are now established in the United States, causing huge economic losses and disrupting valued American ecosystems. Biological invaders pose risks to native species, human and wildlife health, and the productivity of agricultural food supplies. Losses caused by just 79 of these taxa were conservatively estimated in 1993 by the U.S. Office of Technology Assessment to be more than $97 billion and increasing. *Bio-security*—protection from dangerous biological introductions—is important to Americans.

Bullfrogs, originally introduced into the Pacific Northwest to produce frog's legs for market, aggressively depress populations of native frogs and salamanders. Photo by Frank Shipley.

The vast mosaic of western U.S. habitats is welcoming to potential biological newcomers. The invaders include plants, animals and microbial pathogens. Weeds like cheatgrass and medusahead now dominate over 3 million acres of public land over 5 western states, fueling many of the nation's largest wildfires. More than 230 non-native species have colonized San Francisco Bay, completely altering estuarine food chains and ecosystem processes. Red tide plankton and human cholera pathogens have been identified in ballast water discharges. Once established, these invasive species can degrade habitats of critically declining native wildlife—indeed, non-indigenous species are often the most critical problem facing western threatened and endangered species, particularly on Pacific islands.

Current USGS research on non-indigenous species cannot fulfill information needs expressed by western resource managers in the Bureau of Land Management, US Fish and Wildlife Service, National Park Service, and numerous tribes, states, and private institutions. Gaps in the USGS program exist for many of the vulnerable habitats of the west—many of which are on federal lands. Risks posed by the invaders are frequently unknown, so managers can't act to prevent damage. Knowledge regarding how to restore native communities once they are degraded by invasive species is largely nonexistent.

In order to fill these gaps, the USGS needs to enhance science activity in the west, working within the bureau's Invasive Species and Emerging Diseases Program. The science would be focused through partnerships with resource



Western invasive species problems cannot be solved without focused scientific investigations. For example, ballast water from vessels—such as this ship passing the USGS Marrowstone Marine Laboratory in Puget Sound—presents huge risks of species introductions to Pacific coastal systems. California and Washington recently passed laws to regulate discharges of ballast water, but scientific information is sorely needed to implement these

managers and conducted using multidisciplinary or integrated approaches depending on the nature of the problem. The initiative would include:

Major Thrusts

Predicting and assessing risks: provide USGS partners with tools and models to anticipate problems; help to better define and manage problems once they occur

Prevention and control: develop strategies and methods to shortstop initial introductions and cost-effectively control invaders once established, based on research to determine how and why invaders are successful

Information management: serve data and information to inform all aspects of invasive species management; reveal trends through monitoring to guide adaptive ecosystem management

High Priority Topics

Fresh Water/Aquatic: define risks posed by aquatic invertebrates; identify exotic fishes and their effects upon declining natives; determine non-native species influences on amphibians; define risks posed by wetland and riparian weed invaders

Myxobolus cerebralis, *the whirling disease parasite, costs the recreational fishing industry millions annually by killing trout such as these juvenile rainbow. The species spread from its introduction in the eastern U.S. to the Rocky Mountains, and is now appearing in the Pacific states. USGS research is needed to help fisheries managers diagnose and control its spread. Photo by Ron Hedrick.*

Coastal/Marine: determine the vulnerability of estuarine benthic communities and planktonic food webs; identify high risk foreign species in advance; determine threats to estuarine ecology

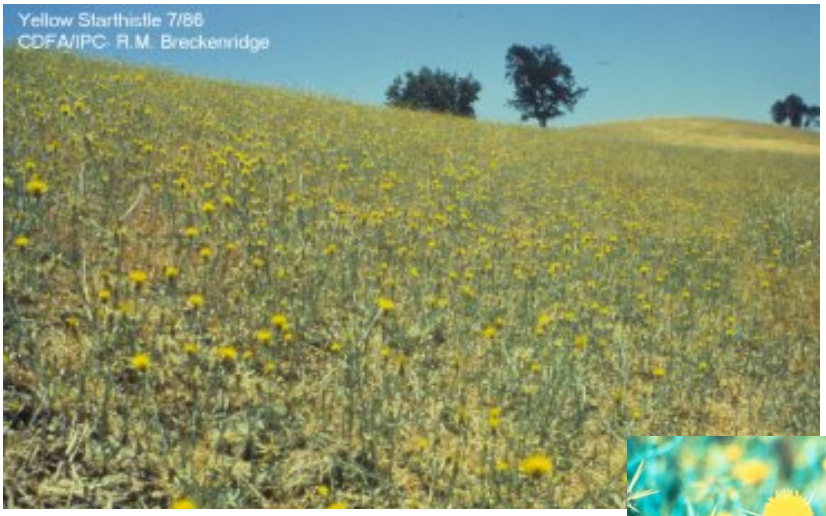
Ballast Water: research and develop effective ballast water treatment methods; assess species transport risks (e.g. by season; biogeographic region of origin); predict vulnerability to invasion for particular valued habitats, ecosystems, and native species complexes

Pacific Islands: develop potential biological controls (e.g. brown tree snakes); assess risks to island habitats for particular invaders by region of origin; provide recovery science for threatened and endangered native species depressed by exotics

Arid and Semiarid Rangeland: identify changes to fire regimes caused by non-indigenous invasions; develop restoration technologies; determine habitat impacts for native wildlife; determine how bio-invasions interact with human habitat perturbations and climate change

Microbial pathogens and parasites: develop genetic tools to identify/diagnose novel pathogens; conduct biocontainment laboratory disease challenges for novel or incipient pathogens to determine virulence and assess risk of epizootics; develop treatment tools and methods

Process understanding: develop information about the ecological processes and mechanisms that foster invasiveness of plants, animals, and pathogens; develop science-based control strategies.



Yellow starthistle was introduced to the western United States from the Mediterranean. It was first found growing near west coast seaports. Starthistle infestations can reduce wildlife habitat and forage, displace native plants, and decrease native plant and animal diversity. Photo by Dave Pyke.

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